

**Rikaline** GPS-6021-X6

**【High Sensitivity】**

# CF GPS Receiver

## User's Guide

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## **0. Quick Use**

### **0.1 Check GPS Package**

#### **0.1.1 Standard Package**

GPS-6021-X6 (GPS Receiver) + CD + Warranty Card + quick installation reference.

#### **0.1.2 Optional Package**

The shop may bundle different accessories for you as follows:

1. Active Antenna
2. PCMCIA Adapter
3. PDA Holder
4. Software (Navigation Software + Digital Map)
5. Others

### **0.2 Check CF Card Slot**

1. The GPS-6021-X6 is a Type I CF device. Many new PDAs are equipped with Type II CF slot. Make sure to slot in properly to avoid damage.
2. When you connect GPS-6021-X6 with your PC (Webpad PC, Tablet PC, Laptop PC or other PCs) with PCMCIA adapter, you need to point to an installation file included in the CD.

### **0.3 Connect GPS-6021-X6 to your machine.**

### **0.4 Turn on your machine & Start GPS function.**

You may need to execute navigation software, then link to GPS device. Your GPS-6021-X6 starts to provide you full GPS function.

### **0.5 Basic Specifications**

1. CF type I: Suitable to CF Type I and Type II slot.

## 1. Introduction

### 1.1 Overview

The **Rikaline GPS-6021-X6 High Sensitivity CF GPS Receiver** is a total solution GPS receiver, designed based on **SiRF Star II** Architecture with the newest **high sensitivity** system. This revolutionary system provides you unbelievable positioning sensitivity allowing you to have easy position fix in urban canyon conditions. This positioning application meets strict needs such as car navigation, mapping, surveying, security, agriculture and so on. Only clear view of sky and certain power supply are necessary to the unit. It communicates with other electronic utilities via compatible dual-channel through RS-232 and saves critical satellite data by built-in backup memory. With low power consumption, the **GPS-6021-X6** tracks up to 12 satellites at a time, re-acquires satellite signals in 100 ms and updates position data every second. Trickle-Power allows the unit operates a fraction of the time and Push-to-Fix permits user to have a quick position fix even though the receiver usually stays off.

### 1.2 Features

The GPS-6021-X6 provides a host of features that make it easy for integration and use.

1. **SiRF Star II** chipset with embedded ARM7TDMI CPU available for customized applications in firmware.
2. High performance receiver tracks up to 12 satellites while providing first fast fix and low power consumption.
3. Differential capability utilizes real-time RTCM corrections producing 1-5 meter position accuracy.
4. Compact design ideal for applications with minimal space.
5. A rechargeable battery sustains internal clock and memory. It is recharged during normal operation.
6. User initialization is not required.
7. Dual communication channels and user selectable baud rates allow maximum interface capability and flexibility.
8. FLASH based program memory: New software revisions upgradeable through serial interface.
9. LED display status: The LED will be "ON" when power connected.
10. Built-in WAAS / EGNOS demodulator.
11. Small size.

### 1.3 Technology specifications

#### 1.3.1 Physical Dimension

Single construction integrated antenna/receiver.

Size: 83.0(H) x 47.5(W) x 14.5(D) (mm)

3.27"(H) x 1.87"(W) x 0.57"(D).

#### 1.3.2 Environmental Characteristics

- 1) Operating temperature: -40°C to +85°C(internal temperature).
- 2) Storage temperature: -55°C to +100°C.

#### 1.3.3 Electrical Characteristics

- 1) Input voltage: +2.5 ~ 5.5 VDC without accessories.
- 2) Backup power: 3V Rechargeable Lithium cell battery, up to 767 hours (31.9 days) discharge.

#### 1.3.4 Performance

- 1) Tracks up to 12 satellites.
- 2) Update rate: 1 second.
- 3) Acquisition time
 

Reacquisition	0.1 sec., averaged
Snap start	2 sec., averaged
Hot start	8 sec., averaged
Warm start	38 sec., averaged

- Cold start 45 sec., averaged
- 4) Position Accuracy
- A) Non DGPS (Differential GPS)
- |          |                                     |
|----------|-------------------------------------|
| Position | 15-meter 2D RMS                     |
|          | 7-meter 2D RMS with WAAS corrected  |
| Velocity | 0.1 meters/second, with SA off      |
| Time     | 1 microsecond synchronized GPS time |
- B) DGPS (Differential GPS)
- |          |                             |
|----------|-----------------------------|
| Position | 1 to 5 meter, typical       |
| Velocity | 0.05 meters/second, typical |
- 5) Dynamic Conditions:
- |              |                                      |
|--------------|--------------------------------------|
| Altitude     | 18,000 meters (60,000 feet) max      |
| Velocity     | 515 meters / second (1000 knots) max |
| Acceleration | 4 G, max                             |
| Jerk         | 20 meters/second <sup>3</sup> , max  |

### 1.3.5 Interfaces

- 1) Dual channel RS-232 level, with user selectable baud rate (4800-Default, 9600, 19200, 38400).
- 2) NMEA 0183 Version 2.2 ASCII output (GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, GPVTG).
- 3) Real-time Differential Correction input (RTCM SC-104 message types 1, 5 and 9).
- 4) SiRF protocol.

## 2. Operational characteristics

### 2.1 Initialization

As soon as the initial self-test is complete, the GPS-6021-X6 begins the process of satellite acquisition and tracking automatically. Under normal circumstances, it takes approximately 45 seconds to achieve a position fix, 38 seconds if ephemeris data is known. After a position fix has been calculated, information about valid position, velocity and time is transmitted over the output channel.

The GPS-6021-X6 utilizes initial data, such as last stored position, date, time and satellite orbital data, to achieve maximum acquisition performance. If significant inaccuracy exists in the initial data, or the orbital data is obsolete, it may take more time to achieve a navigation solution. The GPS-6021-X6 Auto-locate feature is capable of automatically determining a navigation solution without intervention from the host system. However, acquisition performance can be improved when the host system initializes the GPS-6021-X6 in the following situation:

- 1) Moving further than 1,500 kilometers.
- 2) Failure of data storage due to the inactive internal memory battery.

### 2.2 Navigation

After the acquisition process is complete, the GPS-6021-X6 sends valid navigation information over output channels. These data include:

- 1) Latitude/longitude/altitude
- 2) Velocity
- 3) Date/time
- 4) Error estimates
- 5) Satellite and receiver status

The GPS-6021-X6 sets the default of auto-searching for real-time differential corrections in RTCM SC-104 standard format, with the message types 1, 5, or 9. It accomplishes the satellite data to generate a differential (DGPS) solution. The host system, at its option, may also command the GPS-6021-X6 to output a position whenever a differential solution is available.

## **3. Hardware interface**

### **3.1 Dimension**

Size: 83.0(H) x 47.5(W) x 14.5(D) (mm)  
3.27"(H) x 1.87"(W) x 0.57"(D).

### **3.2 Hardware Interface**

The GPS-6021-X6 includes an antenna in a unique style gadget. Simply put it into a CF card slot or insert it into PCMCIA slot through a PCMCIA adapter of any type of PC with Windows OS. The interface is through a standard 50-pin PCMCIA connector with RS-232 level.

### **3.3 Connector**

- 1) Standard 50-pin CF female connector.
- 2) Optional active antenna female connector.

#### **3.3.1 Function definition of CF card connector**

Please download detail at <http://compactflash.org/specd11.htm>

### **3.4 Accessories**

#### **3.4.1 Active Antenna**

- A-10302-M Active Antenna with 2 meter 180° MMCX connector
- A-10305-M Active Antenna with 5 meter 180° MMCX connector

## **4. PCMCIA Installation File**

### **4.1 System Requirements**

IBM, Pentium or other compatible PC, Windows 98/Me/2000.

### **4.2 Installation**

1. Turn your PC.
2. Your PC will show new device found.
3. Indicate to the direction you store GPS-6021-X6.inf file.
4. Click "Yes". Your PC will installation the file automatically.

**Note:** 1// The GPS-6021-X6.inf installation file is needed when a PCMCIA adapter used.  
2// PDA does not need to install any extra file.

## **5. Warranty**

The GPS-6021-X6 is warranted to be free from defects in material and functions for one year from the date of purchase. Any failure of this product within this period under normal conditions will be replaced at no charge to the customers.



## Appendix A Software Interface

The GPS-6021-X6 interface protocol is based on the National Marine Electronics Association's NMEA 0183 ASCII interface specification, which is defined in NMEA 0183, Version 2.2 and the Radio Technical Commission for Maritime Services (RTCM Recommended Standards For Differential Navstar GPS Service, Version 2.1, RTCM Special Committee No.104).

### A.1 NMEA Transmitted Messages

The GPS-6021-X6 supported by SiRF Technology Inc. also outputs data in NMEA-0183 format as defined by the National Marine Electronics Association (NMEA), Standard.

The default communication parameters for NMEA output are 4800 baud, 8 data bits, stop bit, and no parity.

**Table A-1 NMEA-0183 Output Messages**

NMEA Sentence	Description
GPGGA	Global positioning system fixed data
GPGLL	Geographic position latitude \ longitude
GPGSA	GNSS DOP and active satellites
GPGSV	GNSS satellites in view.
GPRMC	Recommended minimum specific GNSS data
GPVTG	Course over ground and ground speed

#### A.1.1 Global Positioning System Fix Data (GGA)

Table A-2 contains the values for the following example:

**\$GPGGA,161229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M, , , 0000\*18**

**Table A-2 GGA Data Format**

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Time	161229.487		Hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 5-3
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	Meters	
Units	M	Meters	
Geoid Separation		Meters	
Units	M	Meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR> <LF>			End of message termination

**Table A-3 Position Fix Indicator**

Value	Description
0	0 Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3	GPS PPS Mode, fix valid

## A.1.2 Geographic Position with Latitude/Longitude (GLL)

Table A-4 contains the values for the following example:

**\$GPGLL,3723.2475,N,12158.3416,W,161229.487,A\*2C**

**Table A-4 GLL Data Format**

Name	Example	Units	Description
Message ID	\$GPGLL		GLL protocol header
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Checksum	*2C		
<CR> <LF>			End of message termination

## A.1.3 GNSS DOP and Active Satellites (GSA)

Table A-5 contains the values for the following example:

**\$GPGSA,A,3,07,02,26,27,09,04,15, , , , ,1.8,1.0,1.5\*33**

**Table A-5 GSA Data Format**

Name	Example	Units	Description
Message ID	\$GPGSA		GSA protocol header
Mode 1	A		See Table 5-6
Mode 2	3		See Table 5-7
Satellite Used (1)	07		Sv on Channel 1
Satellite Used (1)	02		Sv on Channel 2
.....			....
Satellite Used			Sv on Channel 12
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*33		
<CR> <LF>			End of message termination

(1) Satellite used in solution.

**Table A-6 Mode 1**

Value	Description
M	Manual—forced to operate in 2D or 3D mode
A	2D Automatic—allowed to automatically switch 2D/3D

**Table A-7 Mode 2**

Value	Description
1	Fix Not Available
2	2D
3	3D

## A.1.4 GNSS Satellites in View (GSV)

Table A-8 contains the values for the following example:

**\$GPGSV,2,1,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42\*71**  
**\$GPGSV,2,2,07,09,23,313,42,04,19,159,41,15,12,041,42\*41**

**Table A-8 GSV Data Format**

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header
Number of Messages	2		Range 1 to 3
Message Number	1		Range 1 to 3
Satellites in View	07		Range 1 to 12
Satellite ID	07		Channel 1 (Range 1 to 32)
Elevation	79	degrees	Channel 1 (Maximum 90)
Azimuth	048	degrees	Channel 1 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
....	....		
Satellite ID	27		Channel 4 (Range 1 to 32)
Elevation	27	degrees	Channel 4 (Maximum 90)
Azimuth	138	degrees	Channel 4 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
Checksum	*71		
<CR> <LF>			End of message termination

**NOTE:** Items <4>,<5>,<6> and <7> repeat for each satellite in view to a maximum of four (4) satellites per sentence. Additional satellites in view information must be sent in subsequent sentences. These fields will be null if unused.

### A.1.5 Recommended Minimum Specific GNSS Data (RMC)

Table A-9 contains the values for the following example:

**\$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598, ,\*10**

**Table A-9 RMC Data Format**

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTC Time	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	Knots	
Course Over Ground	309.62	Degrees	True
Date	120598		ddmmyy
Magnetic Variation (1)		Degrees	E=east or W=west
Checksum	*10		
<CR> <LF>			End of message termination

(1) SiRF Technology Inc. does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.

### A.1.6 Course Over Ground and Ground Speed

Table A-10 contains the values for the following example:

**\$GPVTG,309.62,T, ,M,0.13,N,0.2,K\*6E**

**Table A-10 VTG Data Format**

Name	Example	Units	Description
Message ID	\$GPVTG		VTG protocol header
Course	309.62	Degrees	Measured heading
Reference	T		True
Course		Degrees	Measured heading

Reference	M		Magnetic (1)
Speed	0.13	Knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	Km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Checksum	*6E		
<CR> <LF>			End of message termination

(1) SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

## A.2 RTCM Received Data

The default communication parameters for DGPS Input are 9600 baud, 8 data bits, stop bit, and no parity. Position accuracy of less than 5 meters can be achieved with the GPS-6021-X6 by using Differential GPS (DGPS) real-time pseudo-range correction data in RTCM SC-104 format, with message types 1, 5, or 9. As using DGPS receiver with different communication parameters, GPS-6021-X6 may decode the data correctly to generate accurate messages and save them in battery-back SRAM for later computing.

## Appendix B Earth Datums & Output Setting

### B.1 Setting

#### B.1.1 Manufacturing Default

Datum: WGS84.  
Baud Rate: 4800.  
Output: GGA, GSA, GSV, RMC.

#### B.1.2 Baud Rate and Output Sentences Setting

##### B.1.2.1 By SiRFdemo Program

- 1// Connect your GPS-6021-X6 to PC (through PCMCIA adapter)
- 2// Execute SiRFdemo.exe (Program is in the CD)
- 3// When "Data Source Setup" shows, select the port (COM 1, 2 or 3....) you used, click "OK".
- 4// Click "Action", select "Open Data Source", Then you will see lots of sentences shows. All the sentences start with \$GPxxxx. This is NMEA protocol. If you do not see these sentences, please click "View", "Select Message", then click "Development". The message will appear. If it still shows nothing, then continue below steps.
- 5// There is a screen "Selection of Target Receiver Software" might appear, please select "SiRFstar II".
- 6// Click "Action", Select "Switch to SiRF Protocol". Then you will see SiRF binary and the sentences start with #Time, shows every 4 lines and you can not see the sentences start with \$GP. These sentences are for setting or viewing the GPS receiver's performance. If your software is using standard NMEA protocol, please do the following:
- 7// Click "Action", Select "Switch to NMEA Protocol". You will see GGA, GSV, GSA and RMC in black and the Baud Rate is 4800. These are the default we put inside the receiver. Please click "OK". Then you can use it as a standard GPS receiver. If your software uses different sentence, please choose the sentences you need.

After above actions, the new setting will be kept in SRAM. If no power supplied to GPS-6021-X6 for more than 30 days, user must re-set again when power on.

##### B.2.2.2 By other SiRF based demo program

There are a few companies or private website providing some very good demo software.

### B.2 Earth Datums

The GPS-6021-X6 is built in earth datum with WGS84.

#### B.2.1 Built –in Earth Datums

The GPS-6021-X6 supports 219 datums. You may change it by following **Change Datum** step by step.

**Note:** dX, dY and dZ are the 3 dimension tolerance with WGS-84 (scale: meter).

	Datum	dX	dY	dZ	Ellipsoid	Region of use	Name in GM-305
1.	WGS-84	0	0	0	WGS 84	Global	WGS 1984
2.	Adindan	-118	-14	218	Clarke 1880	Burkina Faso	Adindan- Burkina Faso
3.	Adindan	-134	-2	210	Clarke 1880	Cameroon	Adindan- Cameroon
4.	Adindan	-165	-11	206	Clarke 1880	Ethiopia	Adindan- Ethiopia
5.	Adindan	-123	-20	220	Clarke 1880	Mali	Adindan- Mali
6.	Adindan	-166	-15	204	Clarke 1880	Mean for Ethiopia; Sudan	Adindan-Regional Mean
7.	Adindan	-128	-18	224	Clarke 1880	Senegal	Adindan- Senegal
8.	Adindan	-161	-14	205	Clarke 1880	Sudan	Adindan- Sudan
9.	Afgooye	-43	-163	45	Krassovsky 1940	Somalia	Afgooye- Somalia
10.	Ain el Abd 1970	-150	-250	-1	International 1924	Bahrain	Ain el Abd'70- Bahrain
11.	Ain el Abd 1970	-143	-236	7	International 1924	Saudi Arabia	Ain el Abd'70- Saudi Arabia
12.	American Samoa 1962	-115	118	426	Clarke 1866	American Samoa Islands	American Samoa'62
13.	Anna 1 Astro 1965	-491	-22	435	Australian National	Cocos Islands	Anna 1 Astro'65

14.	Antigua Island Astro 1943	-270	13	62	Clarke 1880	Antigua (Leeward Islands)	Antigua Island Astro'43
15.	Arc 1950	-138	-105	-289	Clarke 1880	Botswana	Arc'50- Botswana
16.	Arc 1950	-153	-5	-292	Clarke 1880	Burundi	Arc'50- Burundi
17.	Arc 1950	-125	-108	-295	Clarke 1880	Lesotho	Arc'50- Lesotho
18.	Arc 1950	-161	-73	-317	Clarke 1880	Malawi	Arc'50- Malawi
19.	Arc 1950	-143	-90	-294	Clarke 1880	Mean for Botswana; Lesotho; Malawi; Swaziland; Zaire; Zambia; Zimbabwe	Arc'50-Regional Mean
20.	Arc 1950	-134	-105	-295	Clarke 1880	Swaziland	Arc'50- Swaziland
21.	Arc 1950	-169	-19	-278	Clarke 1880	Zaire	Arc'50- Zaire
22.	Arc 1950	-147	-74	-283	Clarke 1880	Zambia	Arc'50- Zambia
23.	Arc 1950	-142	-96	-293	Clarke 1880	Zimbabwe	Arc'50- Zimbabwe
24.	Arc 1960	-160	-6	-302	Clarke 1880	MEAN FOR Kenya; Tanzania	Arc'60- Mean of Kenya, Tanzania
25.	Arc 1960	-157	-2	-299	Clarke 1880	Kenya	Arc'60- Kenya
26.	Arc 1960	-175	-23	-303	Clarke 1880	Tanzania	Arc'60- Tanzania
27.	Ascension Island 1958	-205	107	53	International 1924	Ascension Island	Ascension Island'58
28.	Astro Beacon E 1945	145	75	-272	International 1924	Iwo Jima	Astro Beacon E'45
29.	Astro DOS 71/4	-320	550	-494	International 1924	St Helena Island	Astro DOS 71/4
30.	Astro Tern Island (FRIG) 1961	114	-116	-333	International 1924	Tern Island	Astro Tern Island
31.	Astronomical Station 1952	124	-234	-25	International 1924	Marcus Island	Astronomical Station'52
32.	Australian Geodetic 1966	-133	-48	148	Australian National	Australia; Tasmania	Australian Geodetic'66
33.	Australian Geodetic 1984	-134	-48	149	Australian National	Australia; Tasmania	Australian Geodetic'84
34.	Ayabelle Lighthouse	-79	-129	145	Clarke 1880	Djibouti	Ayabelle Lighthouse
35.	Bellevue (IGN)	-127	-769	472	International 1924	Efate & Erromango Islands	Bellevue
36.	Bermuda 1957	-73	213	296	Clarke 1866	Bermuda	Bermuda 1957
37.	Bissau	-173	253	27	International 1924	Guinea-Bissau	Bissau
38.	Bogota Observatory	307	304	-318	International 1924	Colombia	Bogota Observatory
39.	Bukit Rimpah	-384	664	-48	Bessel 1841	Indonesia (Bangka & Belitung Ids)	Bukit Rimpah
40.	Camp Area Astro	-104	-129	239	International 1924	Antarctica (McMurdo Camp Area)	Camp Area Astro
41.	Campo Inchauspe	-148	136	90	International 1924	Argentina	Campo Inchauspe
42.	Canton Astro 1966	298	-304	-375	International 1924	Phoenix Islands	Canton Astro'66
43.	Cape	-136	-108	-292	Clarke 1880	South Africa	Cape- South Africa
44.	Cape Canaveral	-2	151	181	Clarke 1866	Bahamas; Florida	Cape Canaveral
45.	Carthage	-263	6	431	Clarke 1880	Tunisia	Carthage- Tunisia
46.	Chatham Island Astro 1971	175	-38	113	International 1924	New Zealand (Chatham Island)	Chatham Island Astro'71
47.	Chua Astro	-134	229	-29	International 1924	Paraguay	Chua Astro- Paraguay
48.	Corrego Alegre	-206	172	-6	International 1924	Brazil	Corrego Alegre
49.	Dabola	-83	37	124	Clarke 1880	Guinea	Dabola- Guinea
50.	Deception Island	260	12	-147	Clarke 1880	Deception Island; Antarctica	Deception Island
51.	Djakarta (Batavia)	-377	681	-50	Bessel 1841	Indonesia (Sumatra)	Djakarta-Batavia
52.	DOS 1968	230	-199	-752	International 1924	New Georgia Islands (Gizo Island)	DOS 1968
53.	Easter Island 1967	211	147	111	International 1924	Easter Island	Easter Island'67
54.	Estonia Coordinate System 1937	374	150	588	Bessel 1841	Estonia	Estonia Coord Sys'37
55.	European 1950	-104	-101	-140	International 1924	Cyprus	Euro'50- Cyprus
56.	European 1950	-130	-117	-151	International 1924	Egypt	Euro'50- Egypt
57.	European 1950	-86	-96	-120	International 1924	England; Channel Islands; Scotland; Shetland Islands	Euro'50- England
58.	European 1950	-86	-96	-120	International 1924	England; Ireland; Scotland; Shetland Islands	Euro'50- North Regional Mean
59.	European 1950	-87	-95	-120	International 1924	Finland; Norway	Euro'50- Finland, Norway
60.	European 1950	-84	-95	-130	International 1924	Greece	Euro'50- Greece
61.	European 1950	-117	-132	-164	International 1924	Iran	Euro'50- Iran

62.	European 1950	-97	-103	-120	International 1924	Italy (Sardinia)	Euro'50-Italy-Sardinia
63.	European 1950	-97	-88	-135	International 1924	Italy (Sicily)	Euro'50-Italy-Sicily
64.	European 1950	-107	-88	-149	International 1924	Malta	Euro'50-Malta
65.	European 1950	-87	-98	-121	International 1924	Mean for Austria; Belgium; Denmark; Finland; France; W Germany; Gibraltar; Greece; Italy; Luxembourg; Netherlands; Norway; Portugal; Spain; Sweden; Switzerland	Euro'50-West Regional Mean
66.	European 1950	-87	-96	-120	International 1924	Mean for Austria; Denmark; France; W Germany; Netherlands; Switzerland	Euro'50-East Regional Mean
67.	European 1950	-103	-106	-141	International 1924	Mean for Iraq; Israel; Jordan; Lebanon; Kuwait; Saudi Arabia; Syria	Euro'50-South Regional Mean
68.	European 1950	-84	-107	-120	International 1924	Portugal; Spain	Euro'50- Portugal,Spain
69.	European 1950	-112	-77	-145	International 1924	Tunisia	Euro'50- Tunisia
70.	European 1979	-86	-98	-119	International 1924	Mean for Austria; Finland; Netherlands; Norway; Spain; Sweden; Switzerland	European 1979
71.	Fort Thomas 1955	-7	215	225	Clarke 1880	Nevis; St. Kitts (Leeward Islands)	Fort Thomas 1955
72.	Gan 1970	-133	-321	50	International 1924	Republic of Maldives	Gan 1970
73.	Geodetic Datum 1949	84	-22	209	International 1924	New Zealand	Geodetic Datum'49
74.	Graciosa Base SW 1948	-104	167	-38	International 1924	Azores (Faial; Graciosa; Pico; Sao Jorge; Terceira)	Graciosa Base SW'48
75.	Guam 1963	-100	-248	259	Clarke 1866	Guam	Guam'63 Guam
76.	Gunung Segara	-403	684	41	Bessel 1841	Indonesia (Kalimantan)	Gunung Segara
77.	GUX 1 Astro	252	-209	-751	International 1924	Guadalcanal Island	GUX 1 Astro
78.	Herat North	-333	-222	114	International 1924	Afghanistan	Herat North
79.	Hermannskogel Datum	653	-212	449	Bessel 1841 (Namibia)	Croatia -Serbia, Bosnia-Herzegovina	Hermannskogel Datum
80.	Hjorsey 1955	-73	46	-86	International 1924	Iceland	Hjorsey 1955
81.	Hong Kong 1963	-156	-271	-189	International 1924	Hong Kong	Hong Kong'63
82.	Hu-Tzu-Shan	-637	-549	-203	International 1924	Taiwan	Hu-Tzu-Shan
83.	Indian	282	726	254	Everest (India 1830)	Bangladesh	Indian- Bangladesh
84.	Indian	295	736	257	Everest (India 1956)	India; Nepal	Indian- India,Nepal
85.	Indian	283	682	231	Everest (Pakistan)	Pakistan	Indian- Pakistan
86.	Indian 1954	217	823	299	Everest (India 1830)	Thailand	Indian 1954
87.	Indian 1960	182	915	344	Everest (India 1830)	Vietnam (Con Son Island)	Indian'60- Con Son Island
88.	Indian 1960	198	881	317	Everest (India 1830)	Vietnam (Near 16øN))	Indian'60-Vietnam
89.	Indian 1975	210	814	289	Everest (India 1830)	Thailand	Indian 1975
90.	Indonesian 1974	-24	-15	5	Indonesian 1974	Indonesia	Indonesian'74
91.	Ireland 1965	506	-122	611	Modified Airy	Ireland	Ireland 1965
92.	ISTS 061 Astro 1968	-794	119	-298	International 1924	South Georgia Islands	ISTS 061 Astro'68
93.	ISTS 073 Astro 1969	208	-435	-229	International 1924	Diego Garcia	ISTS 073 Astro'69
94.	Johnston Island 1961	189	-79	-202	International 1924	Johnston Island	Johnston Island'61
95.	Kandawala	-97	787	86	Everest (India 1830)	Sri Lanka	Kandawala
96.	Kerguelen Island 1949	145	-187	103	International 1924	Kerguelen Island	Kerguelen Island'49
97.	Kertau 1948	-11	851	5	Everest (Malay. & Sing)	West Malaysia & Singapore	Kertau 1948
98.	Kusaie Astro 1951	647	177 7	-1124	International 1924	Caroline Islands	Kusaie Astro'51
99.	Korean Geodetic System	0	0	0	GRS 80	South Korea	Korean Geo Sys
100.	L. C. 5 Astro 1961	42	124	147	Clarke 1866	Cayman Brac Island	L. C. 5 Astro'61
101.	Leigon	-130	29	364	Clarke 1880	Ghana	Leigon
102.	Liberia 1964	-90	40	88	Clarke 1880	Liberia	Liberia 1964
103.	Luzon	-133	-77	-51	Clarke 1866	Philippines (Excluding Mindanao)	Luzon-Philip
104.	Luzon	-133	-79	-72	Clarke 1866	Philippines (Mindanao)	Luzon-Philip- Mindanao
105.	M'Poraloko	-74	-130	42	Clarke 1880	Gabon	M'Poraloko

106	Mahe 1971	41	-220	-134	Clarke 1880	Mahe Island	Mahe 1971
107	Massawa	639	405	60	Bessel 1841	Ethiopia (Eritrea)	Massawa
108	Merchich	31	146	47	Clarke 1880	Morocco	Merchich
109	Midway Astro 1961	912	-58	1227	International 1924	Midway Islands	Midway Astro'61
110	Minna	-81	-84	115	Clarke 1880	Cameroon	Minna- Cameroon
111	Minna	-92	-93	122	Clarke 1880	Nigeria	Minna- Nigeria
112	Montserrat Island Astro 1958	174	359	365	Clarke 1880	Montserrat (Leeward Islands)	Montserrat Island Astro'58
113	Nahrwan	-247	-148	369	Clarke 1880	Oman (Masirah Island)	Nahrwan-Oman-Masirah Island
114	Nahrwan	-243	-192	477	Clarke 1880	Saudi Arabia	Nahrwan- Saudi Arabia
115	Nahrwan	-249	-156	381	Clarke 1880	United Arab Emirates	Nahrwan- United Arab Emirates
116	Naparima BWI	-10	375	165	International 1924	Trinidad & Tobago	Naparima BWI
117	North American 1927	-5	135	172	Clarke 1866	Alaska (Excluding Aleutian Ids)	N-Amer'27-Alaska
118	North American 1927	-2	152	149	Clarke 1866	Alaska (Aleutian Ids East of 180°W)	N-Amer'27-Aleutian Ids E
119	North American 1927	2	204	105	Clarke 1866	Alaska (Aleutian Ids West of 180°W)	N-Amer'27-Aleutian Ids W
120	North American 1927	-4	154	178	Clarke 1866	Bahamas (Except San Salvador Id)	N-Amer'27-Bahamas
121	North American 1927	1	140	165	Clarke 1866	Bahamas (San Salvador Island)	N-Amer'27-San Salvador
122	North American 1927	-7	162	188	Clarke 1866	Canada (Alberta; British Columbia)	N-Amer'27-Alberta
123	North American 1927	-9	157	184	Clarke 1866	Canada (Manitoba; Ontario)	N-Amer'27- Manitoba, Ontario
124	North American 1927	-22	160	190	Clarke 1866	Canada (New Brunswick; Newfoundland; Nova Scotia; Quebec)	N-Amer'27- New Brunswick
125	North American 1927	4	159	188	Clarke 1866	Canada (Northwest Territories; Saskatchewan)	N-Amer'27- Saskatchewan
126	North American 1927	-7	139	181	Clarke 1866	Canada (Yukon)	N-Amer'27- Yukon
127	North American 1927	0	125	201	Clarke 1866	Canal Zone	N-Amer'27-Canal Zone
128	North American 1927	-9	152	178	Clarke 1866	Cuba	N-Amer'27-Cuba
129	North American 1927	11	114	195	Clarke 1866	Greenland (Hayes Peninsula)	N-Amer'27-Greenland
130	North American 1927	-3	142	183	Clarke 1866	Mean for Antigua; Barbados; Barbuda; Caicos Islands; Cuba; Dominican Republic; Grand Cayman; Jamaica; Turks Islands	N-Amer'27-Antigua, Barbados
131	North American 1927	0	125	194	Clarke 1866	Mean for Belize; Costa Rica; El Salvador; Guatemala; Honduras; Nicaragua	N-Amer'27-Costa Rica, El Salvador
132	North American 1927	-10	158	187	Clarke 1866	Mean for Canada	N-Amer'27- Mean of Canada
133	North American 1927	-8	160	176	Clarke 1866	Mean for Conus	N-Amer'27-Mean of Conus
134	North American 1927	-9	161	179	Clarke 1866	Mean for Conus (East of Mississippi; River Including Louisiana; Missouri; Minnesota)	N-Amer'27-E-Mississippi
135	North American 1927	-8	159	175	Clarke 1866	Mean for Conus (West of Mississippi; River Excluding Louisiana; Minnesota; Missouri)	N-Amer'27-W-Mississippi
136	North American 1927	-12	130	190	Clarke 1866	Mexico	N-Amer'27-Mexico
137	North American 1983	0	0	0	GRS 80	Alaska (Excluding Aleutian Ids)	N-Amer'83-Alaska
138	North American 1983	-2	0	4	GRS 80	Aleutian Ids	N-Amer'83-Aleutian Ids
139	North American 1983	0	0	0	GRS 80	Canada	N-Amer'83-Canada
140	North American 1983	0	0	0	GRS 80	Conus	N-Amer'83-Conus



141	North American 1983	1	1	-1	GRS 80	Hawaii	N-Amer'83-Hawaii
142	North American 1983	0	0	0	GRS 80	Mexico; Central America	N-Amer'83-Mexico, Central America
143	North Sahara 1959	-186	-93	310	Clarke 1880	Algeria	North Sahara'59
144	Observatorio Meteorologico 1939	-425	-169	81	International 1924	Azores (Corvo & Flores Islands)	Observatorio Meteorologico'39
145	Old Egyptian 1907	-130	110	-13	Helmert 1906	Egypt	Old Egyptian 1907
146	Old Hawaiian	89	-279	-183	Clarke 1866	Hawaii	Old Hawaiian- Hawaii
147	Old Hawaiian	45	-290	-172	Clarke 1866	Kauai	Old Hawaiian- Kauai
148	Old Hawaiian	65	-290	-190	Clarke 1866	Mauai	Old Hawaiian- Maui
149	Old Hawaiian	61	-285	-181	Clarke 1866	Mean For Hawaii; Kauai; Maui; Oahu	Old Hawaiian-Regional Mean
150	Old Hawaiian	58	-283	-182	Clarke 1866	Oahu	Old Hawaiian- Oahu
151	Oman	-346	-1	224	Clarke 1880	Oman	Oman
152	Ordnance Survey Great Britain 1936	371	-112	434	Airy 1830	England	Ord Sur GB'36-England
153	Ordnance Survey Great Britain 1936	371	-111	434	Airy 1830	England; Isle of Man; Wales	Ord Sur GB'36- Isle of Man
154	Ordnance Survey Great Britain 1936	375	-111	431	Airy 1830	Mean For England; Isle of Man; Scotland; Shetland Islands; Wales	Ord Sur GB'36-Regional Mean
155	Ordnance Survey Great Britain 1936	384	-111	425	Airy 1830	Scotland; Shetland Islands	Ord Sur GB'36-Scotland, Shetland
156	Ordnance Survey Great Britain 1936	370	-108	434	Airy 1830	Wales	Ord Sur GB'36- Wales
157	Pico de las Nieves	-307	-92	127	International 1924	Canary Islands	Pico de las Nieves
158	Pitcairn Astro 1967	185	165	42	International 1924	Pitcairn Island	Pitcairn Astro 1967
159	Point 58	-106	-129	165	Clarke 1880	MEAN FOR Burkina Faso & Niger	Point 58
160	Pointe Noire 1948	-148	51	-291	Clarke 1880	Congo	Pointe Noire 1948
161	Porto Santo 1936	-499	-249	314	International 1924	Porto Santo; Madeira Islands	Porto Santo 1936
162	Provisional South American 1956	-270	188	-388	International 1924	Bolivia	Prov S-Amer'56-Bolivia
163	Provisional South American 1956	-270	183	-390	International 1924	Chile (Northern; Near 19 øS)	Prov S-Amer'56-Chile-North
164	Provisional South American 1956	-305	243	-442	International 1924	Chile (Southern; Near 43 øS)	Prov S-Amer'56-Chile-South
165	Provisional South American 1956	-282	169	-371	International 1924	Colombia	Prov S-Amer'56-Colombia
166	Provisional South American 1956	-278	171	-367	International 1924	Ecuador	Prov S-Amer'56-Ecuador
167	Provisional South American 1956	-298	159	-369	International 1924	Guyana	Prov S-Amer'56-Guyana
168	Provisional South American 1956	-288	175	-376	International 1924	Mean for Bolivia; Chile; Colombia; Ecuador; Guyana; Peru; Venezuela	Prov S-Amer'56-Regional Mean
169	Provisional South American 1956	-279	175	-379	International 1924	Peru	Prov S-Amer'56- Peru
170	Provisional South American 1956	-295	173	-371	International 1924	Venezuela	Prov S-Amer'56-Venezuela
171	Provisional South Chilean 1963	16	196	93	International 1924	Chile (Near 53 øS) (Hito XVIII)	Prov S-Chilean'63
172	Puerto Rico	11	72	-101	Clarke 1866	Puerto Rico; Virgin Islands	Puerto Rico
173	Pulkovo 1942	28	-130	-95	Krassovsky 1940	Russia	Pulkovo 1942
174	Qatar National	-128	-283	22	International 1924	Qatar	Qatar National
175	Qornoq	164	138	-189	International 1924	Greenland (South)	Qornoq
176	Reunion	94	-948	-1262	International 1924	Mascarene Islands	Reunion
177	Rome 1940	-225	-65	9	International 1924	Italy (Sardinia)	Rome 1940
178	S-42 (Pulkovo 1942)	28	-121	-77	Krassovsky 1940	Hungary	S-42 Pul'42- Hungary
179	S-42 (Pulkovo 1942)	23	-124	-82	Krassovsky 1940	Poland	S-42 Pul'42- Poland
180	S-42 (Pulkovo 1942)	26	-121	-78	Krassovsky 1940	Czechoslovakia	S-42 Pul'42-

							Czechoslovakia
181	S-42 (Pulkovo 1942)	24	-124	-82	Krassovsky 1940	Latvia	S-42 Pul'42- Latvia
182	S-42 (Pulkovo 1942)	15	-130	-84	Krassovsky 1940	Kazakhstan	S-42 Pul'42- Kazakhstan
183	S-42 (Pulkovo 1942)	24	-130	-92	Krassovsky 1940	Albania	S-42 Pul'42- Albania
184	S-42 (Pulkovo 1942)	28	-121	-77	Krassovsky 1940	Romania	S-42 Pul'42- Romania
185	S-JTSK	589	76	480	Bessel 1841	Czechoslovakia (Prior 1 JAN 1993)	S-JTSK
186	Santo (DOS) 1965	170	42	84	International 1924	Espirito Santo Island	Santo DOS'65
187	Sao Braz	-203	141	53	International 1924	Azores (Sao Miguel; Santa Maria Ids)	Sao Braz
188	Sapper Hill 1943	-355	21	72	International 1924	East Falkland Island	Sapper Hill'43
189	Schwarzeck	616	97	-251	Bessel 1841 (Namibia)	Namibia	Schwarzeck
190	Selvagem Grande 1938	-289	-124	60	International 1924	Salvage Islands	Selvagem Grande'38
191	Sierra Leone 1960	-88	4	101	Clarke 1880	Sierra Leone	Sierra Leone'60
192	South American 1969	-62	-1	-37	South American 1969	Argentina	S-Amer'69- Argentina
193	South American 1969,	-61	2	-48	South American 1969	Bolivia	S-Amer'69- Bolivia
194	South American 1969,	-60	-2	-41	South American 1969	Brazil	S-Amer'69- Brazil
195	South American 1969,	-75	-1	-44	South American 1969	Chile	S-Amer'69- Chile
196	South American 1969,	-44	6	-36	South American 1969	Colombia	S-Amer'69- Colombia
197	South American 1969,	-48	3	-44	South American 1969	Ecuador	S-Amer'69- Ecuador
198	South American 1969,	-47	26	-42	South American 1969	Ecuador (Baltra; Galapagos)	S-Amer'69- Baltra, Galapagos
199	South American 1969,	-53	3	-47	South American 1969	Guyana	S-Amer'69- Guyana
200	South American 1969,	-57	1	-41	South American 1969	Mean for Argentina; Bolivia; Brazil; Chile; Colombia; Ecuador; Guyana; Paraguay; Peru; Trinidad & Tobago; Venezuela	S-Amer'69-Regional Mean
201	South American 1969,	-61	2	-33	South American 1969	Paraguay	S-Amer'69- Paraguay
202	South American 1969,	-58	0	-44	South American 1969	Peru	S-Amer'69- Peru
203	South American 1969,	-45	12	-33	South American 1969	Trinidad & Tobago	S-Amer'69- Trinidad, Tobago
204	South American 1969,	-45	8	-33	South American 1969	Venezuela	S-Amer'69- Venezuela
205	South Asia	7	-10	-26	Modified Fischer 1960	Singapore	South Asia
206	Tananarive Observatory 1925	-189	-242	-91	International 1924	Madagascar	Tananarive Observ'25
207	Timbalai 1948	-679	669	-48	Everest (Sabah Sarawak)	Brunei; E. Malaysia (Sabah Sarawak)	Timbalai 1948
208	Tokyo	-148	507	685	Bessel 1841	Japan	Tokyo- Japan
209	Tokyo	-148	507	685	Bessel 1841	Mean for Japan; South Korea; Okinawa	Tokyo-Regional Mean
210	Tokyo	-158	507	676	Bessel 1841	Okinawa	Tokyo- Okinawa
211	Tokyo	-147	506	687	Bessel 1841	South Korea	Tokyo- South Korea
212	Tristan Astro 1968	-632	438	-609	International 1924	Tristan da Cunha	Tristan Astro'68
213	Viti Levu 1916	51	391	-36	Clarke 1880	Fiji (Viti Levu Island)	Viti Levu 1916
214	Voirol 1960	-123	-206	219	Clarke 1880	Algeria	Voirol 1960
215	Wake Island Astro 1952	276	-57	149	International 1924	Wake Atoll	Wake Island Astro'52
216	Wake-Eniwetok 1960	102	52	-38	Hough 1960	Marshall Islands	Wake-Eniwetok'60
217	WGS 1972	0	0	0	WGS 72	Global Definition	WGS 1972
218	Yacare	-155	171	37	International 1924	Uruguay	Yacare
219	Zanderij	-265	120	-358	International 1924	Suriname	Zanderij

## Appendix C Ordering Information

### C.1 Product Options

#### C.1.1 Standard Package

GPS-6021-X6: CF GPS with main unit, CD, Warranty card and quick reference.

#### C.1.2 Optional Accessories

##### C.1.2.1 Active Antenna

A-10302-M Active Antenna with 2 meter 180° MMCX connector

A-10305-M Active Antenna with 5 meter 180° MMCX connector

##### C.1.2.1 PDA Holder

1	A-2001	PDA Holder, Suction Cup, 150mm, Short Arm
2	A-2001-L	PDA Holder, Suction Cup, 150-320mm Adjustable
3	A-2002	PDA Holder, Suction Cup, 150mm, Short Arm, Magnetic Pad
4	A-2002-L	PDA Holder, Suction Cup, 320mm, Long Arm, Magnetic Pad
5	A-2005	PDA Holder, Suction Cup, 150mm, Short Arm, 4-Claw
6	A-2005-L	PDA Holder, Suction Cup, 320mm Long Arm, 4-Claw
7	A-2006	PDA Holder, Suction Cup, 150mm Short Arm, 3-Claw
8	A-2006-L	PDA Holder, Suction Cup, 150mm Long Arm, 3-Claw